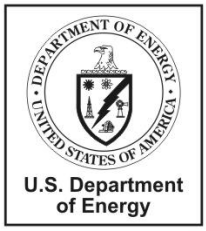
DOE–EM/GJ851–2005

Environmental Air Monitoring Data Quarterly Report for the Moab, Utah, Site

Fourth Quarter 2004
(October through December)

April 2005



Office of Environmental Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Environmental Management.

Moab, Utah

Environmental Air Monitoring Results
October - December, 2004

Environmental Data Report Contents

This Environmental Air Monitoring Data Report includes the following information:

Item No.	Description of Contents
1.	**Summary of Results**
2.	**Data Assessment**, which includes the following: a. Field activities verification checklist. b. Data Assessment Summary.
3.	**Environmental Air Monitoring Data**. a. Atmospheric Radon-222 and Direct Gamma Radiation Data Table. b. Radio-particulate Data Table. c. Time versus Concentration graphs.
4.	**Sample Location Maps**.

Summary of Results

Site: Moab, Utah

Sampling Period: October - December, 2004

SUMMARY

Radio-particulates: No standards or radiological exposure limits were exceeded at any of the nine radio-particulate monitoring locations during the current monitoring period. Analytical data for all analytes (Radium-226, Th-230, Polonium-210, and Uranium-total) were below their respective Derived Concentration Guidelines (DCGs), as found in DOE Order 5400.5, *Radiation Protection of the Public and Environment*. Concentrations of the radio-particulates have been consistently below DCGs since DOE took ownership of the site in 2001. (See Figures 1 through 4).

Radon-222: DOE Order 5400.5, *Radiation Protection of the Public and Environment*, establishes a guideline for atmospheric emissions of radon-222 gas that is applicable to the Moab Site. This guideline is 3.0 picocuries per liter (pCi/L) above background. Background concentrations of radon-222 in the Moab area have been measured to be approximately 0.6 pCi/L; therefore, the guideline for radon-222 emissions at the Moab Site is 3.6 pCi/L. Monitoring data collected from the fourth quarter of 2004, indicate that this guideline was exceeded at three on-site monitoring locations as shown in Tables 1 and 2. Duplicate detectors were also deployed off-site at the Maximally Exposed Individual (MEI) location, which represents the member of the public residing closest to the tailings pile and is considered to have the greatest potential for exposure. None of the off-site radon monitoring locations, including the MEI location, exceeded DOE's monitoring guideline for radon. This is common for an unremediated tailings pile.

Direct Environmental Gamma Radiation: DOE Order 5400.5, *Radiation Protection of the Public and Environment*, establishes a dose limit of 100 millirem per year (mrem/yr) above naturally occurring radiation levels (background). Background gamma radiation for the Moab area has been measured at approximately 81 mrem/yr; therefore, the gamma dose limit for the Moab Site is 181 mrem/yr. Although radiation doses are summed at the end of a calendar year to determine the actual dose, the annual dose may be estimated from the quarterly monitoring results. Based on the monitoring data collected from the fourth quarter of 2004, elevated gamma measurements were observed at nine on-site monitoring locations as shown in Tables 1 and 2. None of the off-site monitoring locations, including the MEI location, exceeded DOE's gamma radiation dose limit. This is common for an unremediated tailings pile.

It should be noted that, although the exposure rates may be exceeded at several locations along the DOE site property boundary, this does not reflect expected doses to the public. These data represent the dose that a member of the public could receive ***if*** that person resided at the point where the data were collected for an entire year. This is not a realistic representation of actual or expected public exposure conditions because no member of the public permanently resides (on an annual basis) at or near these elevated locations. Monitoring data observed at the MEI location represents the only true residential exposure. These data are less than the DOE annual

public dose limit (100 mrem/yr), therefore, the dose limit to the public is not being exceeded, even at adjacent lands where the public has access on a transient or short term basis.

Table 1. Moab Environmental Air Monitoring Locations with Samples that Exceeded Applicable Regulatory Standards, Limits, or Guidelines during the Fourth Quarter, 2004

ANALYTE	STANDARD / GUIDELINE	SAMPLING LOCATIONS EXCEEDING STANDARDS / GUIDELINES
Radon-222	3.6 pCi/L	MPS-0106, MPS-0107, MPS-0108
Direct Gamma Radiation	181 mrem/yr	MPS-0101, MPS-0105, MPS-0106, MPS-0107, MPS-0108, MPS-0109, MPS-0110, MPS-0111, MPS-0113

Toby Wright
Moab Project Manager

4/7/05
Date

DATA ASSESSMENT

Environmental Air Monitoring Field Activities Verification Checklist

Project Moab Site
Date(s) of Verification 03/29/05

Date(s) of Air Monitoring 09/29/04 – 12/29/04
Name of Verifier Michael J. Gardner

	Response (Yes, No, N/A)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
2. Were the sampling locations specified in the SAP?	Yes	
3. Were all low-volume air samplers operating at 60 liters/minute?	Yes	
Did any of the samplers require air flow adjustment?	No	
4. Were detectors (radon cups, TLDs) and monitoring equipment found to be in undisturbed and operable condition upon arrival?	Yes	
5. Were the hourly clocks on the low-volume air samplers operational upon arrival?	No	Clocks were not functional at: MPS-0105; MPS-0118; and MPS-0123
Were the run times recorded for each radio-particulate monitoring location?	Yes	Run times for the above locations were based on average run times of all other functional monitoring locations. New clocks will be installed on all units.
6. Were duplicates (for radon and gamma radiation) taken at a frequency of one per 20 samples?	Yes	
7. Were equipment blanks (for radio-particulates) taken at a frequency of one per 20 samples?	Yes	
8. Were trip blanks (for radon and gamma radiation) included with each shipment?	Yes	
9. Was the identity of the QC sample locations protected?	Yes	
Were the true locations of the QC samples recorded in the Field Log Book?	Yes	
10. Were all samples collected as specified in the SAP?	Yes	
11. Were chain of custody records completed and was sample custody maintained?	Yes	
12. Are field data sheets signed and dated by sampling personnel?	Yes	
13. Was all other pertinent information documented on the field data sheets?	Yes	

MOAB, UTAH
MOAB SITE
FOURTH QUARTER 2004 SAMPLING
DATA ASSESSMENT SUMMARY

RADIO-PARTICULATE ANALYSES

All radio-particulate samples were analyzed by Severn Trent Laboratories (STL)-St. Louis, MO, a contract laboratory providing analytical services to DOE's Office of Environmental Management located in Grand Junction, Colorado. Radioparticulate samples for the fourth quarter of 2004 were sent to STL for analysis on January 3, 2005.

STL analyzed the glass fiber (47 mm) air filters for radio-particulates (Ra-226, Th-230, Po-210, and U-total). Analytical results for the fourth quarter 2004 sampling period are reported by STL in Report Identification Number (RIN) 05010152. Polonium-210 and Thorium-230 were analyzed by alpha spectrometry, STL methods STL-RC-0210 and EML A-01-R MOD respectively. Radium-226 was analyzed by gas proportional counting, STL method EML RA-06-RC MO. Total uranium was analyzed by inductively coupled plasma-mass spectrometry, EPA method SW-846 6020. Radio-particulate analytical data for samples collected during the fourth quarter of 2004 were reviewed, validated, and summarized in the *Data Review and Validation Report for RIN 05010152* (February 15, 2005), which was prepared and issued by the Grand Junction site laboratory and sample coordinator.

ATMOSPHERIC RADON-222 ANALYSES

Radon cups were analyzed by Landauer, Inc., in accordance with Landauer's *Quality Assurance Manual for Radon Monitoring Services, Revision Number 9, October 17, 2002*. Fourth quarter 2004 analytical radon data were received in a report dated February 15, 2005 . Unlike radio-particulate analyses, radon-222 data are not reported with qualifiers. The laboratory will make a special note/comment in the event that the detectors are missing, damaged, or the detectors cannot be read. Once the data report is received, sampling personnel review all data to insure that the results are consistent with other data points, and with previous data collected for each monitoring location. Data are randomly checked (hand-calculated) to verify that the reported concentrations/results are accurate. These quality assurance checks are conducted at an interval of one in every 10 results.

DIRECT ENVIRONMENTAL GAMMA RADIATION ANALYSES

Thermoluminescent dosimeters (TLDs), used for continuous dose measurements at the Moab Site, are analyzed by Environmental, Inc., Midwest Laboratory, in accordance with their analytical procedure *Preparation and Readout of Teledyne Isotopes TLD Card, TIML-TLD-01, Revision 6* (Teledyne Isotopes, 1995). Fourth quarter 2004 environmental gamma radiation data were received in a report dated February 2, 2005. All data are reported at the 95% confidence level (2 sigma). Once the data report is received, sampling personnel review all data to insure that the results are consistent with other data points, and with previous data collected for each monitoring location. Data are randomly checked (hand-calculated) to verify that the reported

results fall within the acceptable limits of counting error. These quality assurance checks are conducted at an interval of one in every 10 results.

FIELD ACTIVITIES

Duplicate samples are collected for direct gamma environmental radiation at 3 locations: 1) MPS-0117, an off-site, background monitoring site, with consistently low readings; 2) MPS-0107, an on-site location with consistently elevated readings; and 3) MPS-0127, an off-site location that is immediately up-wind of the City of Moab, and is directly south of the Moab Site. Duplicate samples for radon-222 monitoring are collected only at the MEI location. The MEI is located immediately east of the Moab Site property boundary, and represents the worst case exposure scenario to a member of the general public.

Duplicate samples are not collected for radio-particulate samples. This decision was made on a cost/benefit basis. Because the radio-particulate sample data collected to date indicate that all of the isotopes are several orders of magnitude below their respective DCGs, the costs associated with purchasing a duplicate sampler, providing additional electrical power, and incurring additional analytical expenses, were not warranted or justified.

SUSPECTED ANOMALIES

All analytical data are reviewed for anomalous or outlying data points. This review consists of evaluating monitoring data against historical and minimum/maximum values, to determine if the reported data are within reasonable, expected ranges. Because there are relatively few sample locations (i.e., data points), and the historical data set is relatively short, this review is currently conducted manually. An automated review of reported analytical data against historical and minimum/maximum values may be initiated at some point in the future once it is determined that the data set has become too large or cumbersome for an accurate, manual review. Based upon a review of the monitoring data collected during the fourth quarter of 2004, no anomalous data points were identified, and the quality of the reported data (with respect to historical and expected minimum/maximum values) is acceptable.

SUMMARY

All data collected during the fourth quarter of 2004 met the applicable laboratory control criteria for their respective analyses, and all data were reviewed by qualified personnel and found to be within the acceptable limits of counting error associated with each matrix. Data reported in this Environmental Air Monitoring Report are considered validated and may be treated as final results.

Michael J. Gardner
Environmental Scientist

04/07/05
Date

ENVIRONMENTAL AIR MONITORING DATA

MOAB, UTAH
MOAB SITE
FOURTH QUARTER 2004 SAMPLING
ENVIRONMENTAL AIR MONITORING DATA SUMMARY

This section contains data summary tables for each of the environmental air monitoring matrixes. Radon and direct environmental gamma radiation are summarized in Table 2; Radio-particulate data are summarized in Table 3. Each data table also displays monitoring data collected during the previous quarters for the calendar year.

Time versus concentration graphs have also been prepared for each matrix. Concentrations over time have been plotted only for selected locations for each matrix. The rationale used for selecting each location is summarized below.

RADIO-PARTICULATES

Radio-particulate monitoring data have been graphed for the following locations: 1) MPS-0102, one of two on-site radio-particulate monitoring locations. MPS-0102 is the radio-particulate sampling location closest to the MEI, and provides useful information regarding the MEI's exposure to airborne particulate matter. 2) MPS-0105 is the other on-site continuous radio-particulate sampler. This monitoring location, located on the bank of the Colorado River, is the particulate monitoring location closest to the emissions source (i.e., the mill tailings pile), and is located in the predominantly down-wind vector of the Moab Site. This location provides particulate emissions information that is relative to the site boundary, and any possible emissions to the Colorado River corridor, and to the Matheson Wetlands Preserve. 3) MPS-0117 (near the Bar-M Chuck Wagon), is a background monitoring location located approximately 5 miles north of the Moab Site property, and represents ambient, or naturally-occurring conditions. 4) MPS-0120 (near the Portal RV Park), is located approximately one mile down-wind of the Moab Site, and represents exposure conditions and impacts that would be typical for the Moab community in general.

RADON-222

Radon-222 monitoring data have been graphed for the following locations: 1) MPS-MEI, this is considered to represent the worst-case exposure scenario to a member of the general public, and represents actual radon-222 exposure conditions at the MEI location. 2) MPS-0107 is located on the southern property boundary of the Moab Site. This location has historically recorded some of the highest radon exposure readings, and is useful in depicting exposure conditions that are found at off-site areas immediately south of the Moab Site. 3) MPS-0117 (near the Bar-M Chuck Wagon), is a background monitoring location located approximately 5 miles north of the Moab Site property, and represents ambient, or naturally-occurring conditions. 4) MPS-0120 (near the Portal RV Park), is located approximately one mile down-wind of the Moab Site, and represents exposure conditions and impacts that would be typical for the Moab community in general.

DIRECT ENVIRONMENTAL GAMMA RADIATION

Environmental gamma radiation data have been graphed for the following locations:
1) MPS-MEI, this is considered to represent the worst-case exposure scenario to a member of the general public, and represents actual gamma radiation exposure conditions at the MEI location. 2) MPS-0107 is located on the southern property boundary of the Moab Site. This location has historically recorded some of the highest gamma radiation exposure readings, and is useful in depicting exposure conditions that are found at off-site areas immediately south of the Moab Site. 3) MPS-0117 (near the Bar-M Chuck Wagon), is a background monitoring location located approximately 5 miles north of the Moab Site property, and represents ambient, or naturally-occurring conditions. 4) MPS-0120 (near the Portal RV Park), is located approximately one mile down-wind of the Moab Site, and represents exposure conditions and impacts that would be typical for the Moab community in general.

Table 2. Summary of Environmental Radon and Gamma Radiation Monitoring Data for the Moab Site for Calendar Year 2004

Station Number	1st Quarter 2004 (1/07/04 - 04/07/04)		2nd Quarter 2004 (04/07/04 - 07/21/04)		3rd Quarter 2004 (07/21/04 - 10/13/04)		4th Quarter 2004 (10/13/04 – 01/18/05)	
	Radon pCi/L	Gamma mR/91 d (EAA)[5]	Radon pCi/L	Gamma mR/91 d (EAA)	Radon pCi/L	Gamma MR/91 d (EAA)	Radon pCi/L	Gamma MR/91 d (EAA)
On Site Locations								
MPS- 0101[1]	2.5	77.5(311)	2.6	60.6(242)	2.3	74.6(299)	3.0	68.0(273)
MPS-0102[1]	2.1	27.5(110)	1.4	20.7(83)	1.2	24.0(96)	2.4	26.4(106)
MPS-0103[1]	2.0	28.8(116)	1.6	20.8(83)	1.5	24.7(99)	2.7	26.8(108)
MPS-0104[1]	3.4	34.9(140)	2.3	25.8(103)	3.0	32.2(129)	2.9	32.3(130)
MPS-0105[1]	5.3	53.6(215)	2.9	44.4(178)	2.4	49.0(197)	3.1	52.8(212)
MPS-0106[1]	9.8	43.2(173)	5.7	36.3(145)	6.4	40.9(164)	6.5	45.3(182)
MPS-0107[1]	6.9	57.1(229)	4.3	50.5(202)	4.5	54.2(217)	5.2	61.9(248)
MPS-0108[1]	6.2	135.0(542)	4.8	125.9(504)	5.6	134.1(538)	6.3	139.0(558)
MPS-0109[1]	2.3	56.6(227)	3.5	53.0(212)	2.5	53.8(216)	2.2	60.2(242)
MPS-0110[1]	1.5	84.3(338)	3.3	78.7(315)	2.7	83.0(333)	2.5	93.1(373)
MPS-0111[1]	1.7	70.8(284)	1.5	57.2(229)	1.0	65.0(261)	1.2	66.2(266)
MPS-0112[1]	2.5	45.0(181)	2.8	33.6(134)	2.4	39.4(158)	2.2	39.1(157)
MPS-0113[1]	3.1	101.8(408)	3.4	79.1(316)	NDA damaged	85.5(343)	3.5	90.1(361)
Off-site Locations								
MPS-0117[2,3]	1.1	25.3(102)	1.2	19.4(78)	0.7	20.5(82)	0.8	26.3(106)
MPS-0118[2]	0.4	28.0(112)	1.0	18.1(72)	0.8	14.8(59)	1.3	22.6(91)
MPS-0119[2]	0.8	26.5(106)	0.7	22.0(88)	1.0	21.1(85)	1.0	28.2(113)
MPS-0120[2]	0.7	20.0(80)	0.6	16.8(67)	0.7	17.7(71)	0.9	25.3(102)
MPS-0121[2]	0.9	23.4(94)	0.3	18.0(72)	0.8	19.1(77)	0.9	24.4(98)
MPS-0122[2]	0.6	20.9(84)	0.6	14.1(56)	0.4	16.9(68)	0.6	20.7(83)
MPS-0123[2,3]	0.4	21.4(86)	0.4	14.3(57)	0.4	17.5(70)	0.6	19.2(77)
MPS-0124[2]	1.5	24.2(97)	1.0	20.6(82)	1.2	19.3(77)	1.7	26.7(107)
MPS-0125[2]	2.5	28.7(115)	2.3	21.4(86)	1.8	23.6(95)	1.9	27.9(112)
MPS-0126[2]	3.1	27.1(109)	1.8	20.5(82)	2.0	22.0(88)	3.5	26.4(106)
MPS-0127[2]	1.6	24.8(100)	0.7	21.0(84)	1.1	19.2(77)	1.3	28.1(113)
MEI[4]	1.5 1.8 (dup)	19.0(76)	0.9 0.8 (dup)	12.2(49)	1.7 1.6 (dup)	14.4(58)	2.5 (2.2 dup)	17.9(72)

[1] On-site monitoring location. Located within DOE property boundary.
[2] Off-site monitoring location.
[3] Designated background monitoring location. Background locations are located at sufficient distances away from the millsite to be free from any affects or influences from potential site contaminants.
[4] The maximally exposed individual (MEI) is the continually occupied residential property that is closest to the DOE property boundary.
[5] "EAA" is the estimated annual average and is calculated by dividing the actual reading by the number of days of the exposure period, then multiplying by 365. Values for annual averages are in units of mrem/yr. For example, the EAA for MPS-0108 is calculated as follows: 135 mR (observed value) / 91 days (exposure period) × 365 days = 542.
NA = Not Applicable.
NDA = No Data Available.

Table 3. Summary of Radio-particulate Air Monitoring Data for the Moab Site for Calendar Year 2004

Station Number	Isotope	First Quarter 2004 (µCi/mL)[5]	Second Quarter 2004 (µCi/mL)	Third Quarter 2004 (µCi/mL)	Fourth Quarter 2004 (µCi/mL)	Annual Average (µCi/mL)
On-Site Locations						
MPS-0102 (East Property Line)	Uranium[1]	6.5E-17	8.1E-17	8.1E-17	5.0E-17	6.9E-17
	Thorium-230[2]	3.7E-17	1.9E-16	2.0E-16	8.8E-17	1.3E-16
	Radium-226[3]	1.2E-16	6.2E-17	1.3E-16	9.8E-17	1.0E-16
	Polonium-210[4]	9.5E-15	2.9E-15	2.3E-15	5.0E-15	5.0E-15
MPS-0105 (River Berm)	Uranium[1]	2.3E-16	2.7E-16	2.4E-16	9.6E-17	2.1E-16
	Thorium-230[2]	1.1E-16	4.1E-16	4.3E-16	1.3E-16	2.7E-16
	Radium-226[3]	1.0E-16	1.9E-16	1.4E-16	1.4E-16	1.4E-16
	Polonium-210[4]	1.1E-14	2.9E-15	2.2E-15	3.6E-15	5.0E-15
Off-Site Locations						
MPS-0117 (Bar M Chuck Wagon)	Uranium[1]	2.2E-17	8.8E-18	2.4E-17	2.1E-17	1.9E-17
	Thorium-230[2]	5.0E-17	1.0E-16	1.1E-16	6.4E-17	8.1E-17
	Radium-226[3]	8.3E-17	6.5E-17	9.8E-17	1.1E-16	8.8E-17
	Polonium-210[4]	1.2E-14	2.6E-15	4.7E-15	3.2E-15	5.5E-15
MPS-0118 (Arches National Park Entrance)	Uranium[1]	9.7E-17	2.9E-17	4.6E-17	2.4E-17	4.9E-17
	Thorium-230[2]	7.9E-17	1.7E-16	2.2E-16	9.7E-17	1.4E-16
	Radium-226[3]	1.2E-16	7.7E-17	1.4E-16	9.9E-17	1.1E-16
	Polonium-210[4]	1.5E-14	4.0E-15	4.9E-15	5.3E-15	7.3E-15
MPS-0119 (Scott Matheson Wetlands Preserve)	Uranium[1]	2.9E-17	1.5E-17	2.2E-17	1.7E-17	2.1E-17
	Thorium-230[2]	5.5E-17	1.4E-16	9.7E-17	7.6E-17	9.1E-17
	Radium-226[3]	1.1E-16	6.8E-17	1.2E-16	1.4E-16	1.1E-16
	Polonium-210[4]	1.4E-14	3.6E-15	3.2E-15	5.5E-15	6.6E-15
MPS-0120 (Portal RV Park)	Uranium[1]	2.6E-17	1.1E-17	2.5E-17	1.6E-17	1.9E-17
	Thorium-230[2]	3.9E-17	2.2E-16	8.7E-17	9.4E-17	1.1E-16
	Radium-226[3]	1.2E-16	8.7E-17	1.3E-16	1.3E-16	1.2E-16
	Polonium-210[4]	1.2E-14	2.6E-15	3.1E-15	3.7E-15	5.3E-15
MPS-0121 (Moab Wastewater Treatment Plant)	Uranium[1]	2.4E-17	1.4E-17	3.3E-17	1.8E-17	2.3E-17
	Thorium-230[2]	6.2E-17	5.8E-17	1.8E-16	4.3E-17	8.5E-17
	Radium-226[3]	1.2E-16	7.5E-17	1.2E-16	1.1E-16	1.0E-16
	Polonium-210[4]	1.4E-14	4.0E-15	3.0E-15	4.1E-15	6.3E-15
MPS-0122 (Grand County Recycling Center)	Uranium[1]	2.7E-17	1.2E-17	2.4E-17	1.5E-17	2.0E-17
	Thorium-230[2]	8.3E-17	9.9E-17	7.6E-17	9.2E-17	8.8E-17
	Radium-226[3]	1.3E-16	6.4E-17	1.4E-16	9.5E-17	1.1E-16
	Polonium-210[4]	1.3E-14	2.9E-15	3.1E-15	4.3E-15	5.9E-15
MPS-0123 (Kane Creek Road)	Uranium[1]	1.9E-17	1.1E-17	2.1E-17	1.3E-17	1.6E-17
	Thorium-230[2]	6.9E-17	8.8E-17	1.2E-16	1.2E-16	1.0E-16
	Radium-226[3]	1.2E-16	1.0E-16	1.0E-16	9.3E-17	1.0E-16
	Polonium-210[4]	1.5E-14	2.3E-15	3.8E-15	5.2E-15	6.4E-15

[1]DOE DCG for Total Uranium = 2.E-12
[2]DOE DCG for Thorium-230 = 4.E-14
[3]DOE DCG for Radium-226 = 1.E-12
[4]DOE DCG for Polonium-210 = 1.E-12
[5]µCi/mL = microCuries per milliliter

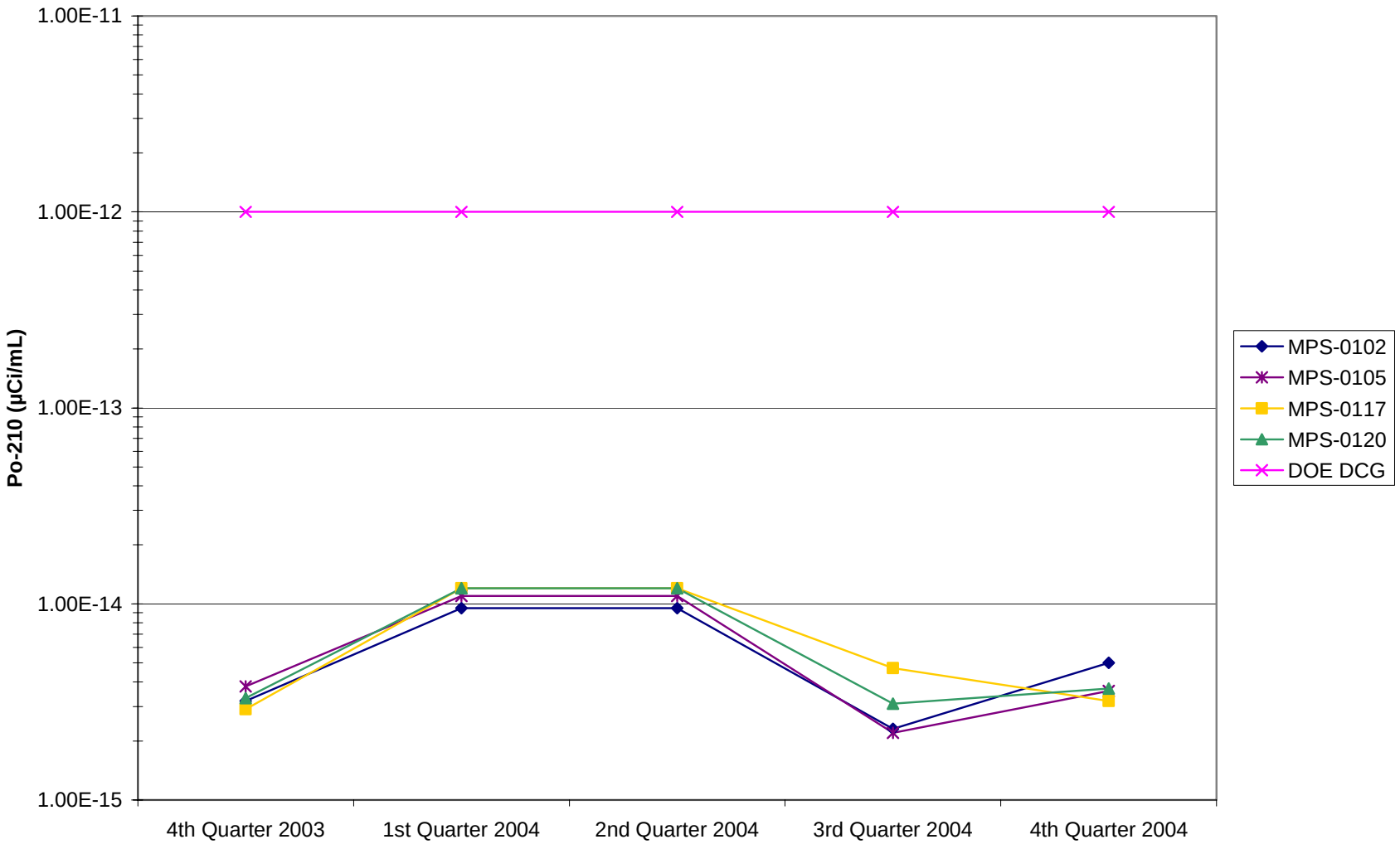


Figure 1. Moab Radio-Particulate Concentration (Po-210)

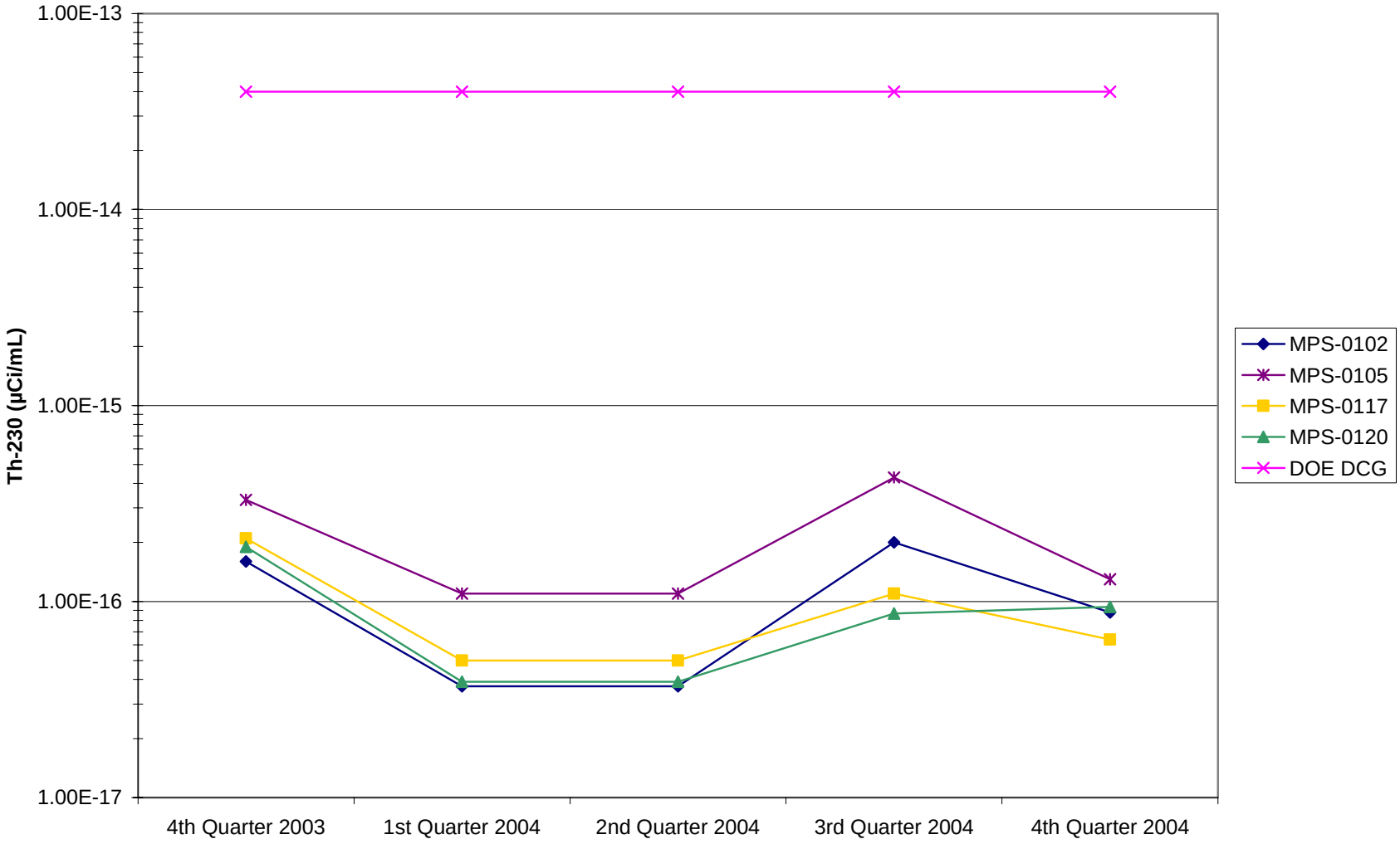


Figure 2. Moab Radio-Particulate Concentration (Th-230)

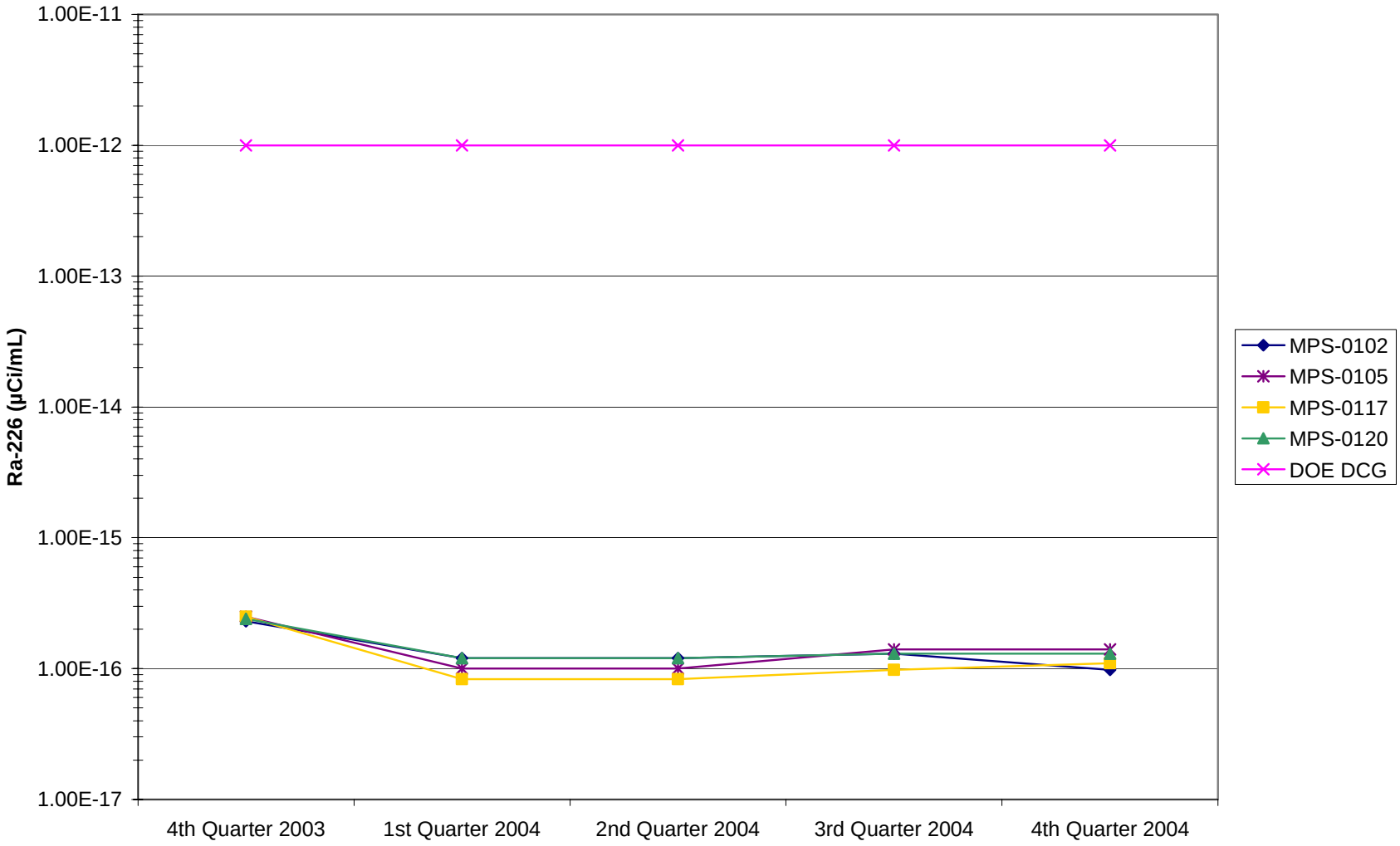


Figure 3. Moab Radio-Particulate Concentration (Ra-226)

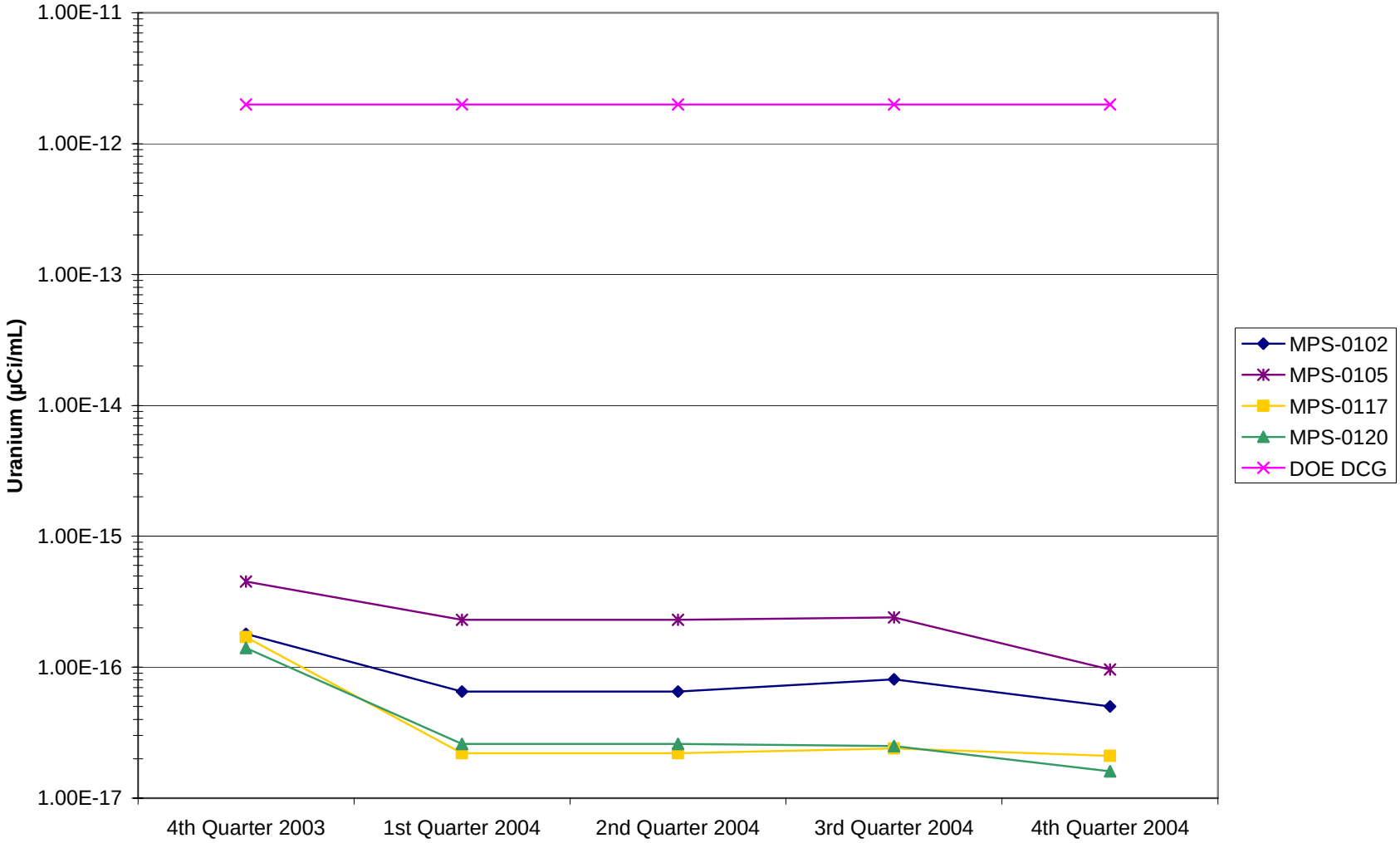


Figure 4. Moab Radio-Particulate Concentration (Uranium)

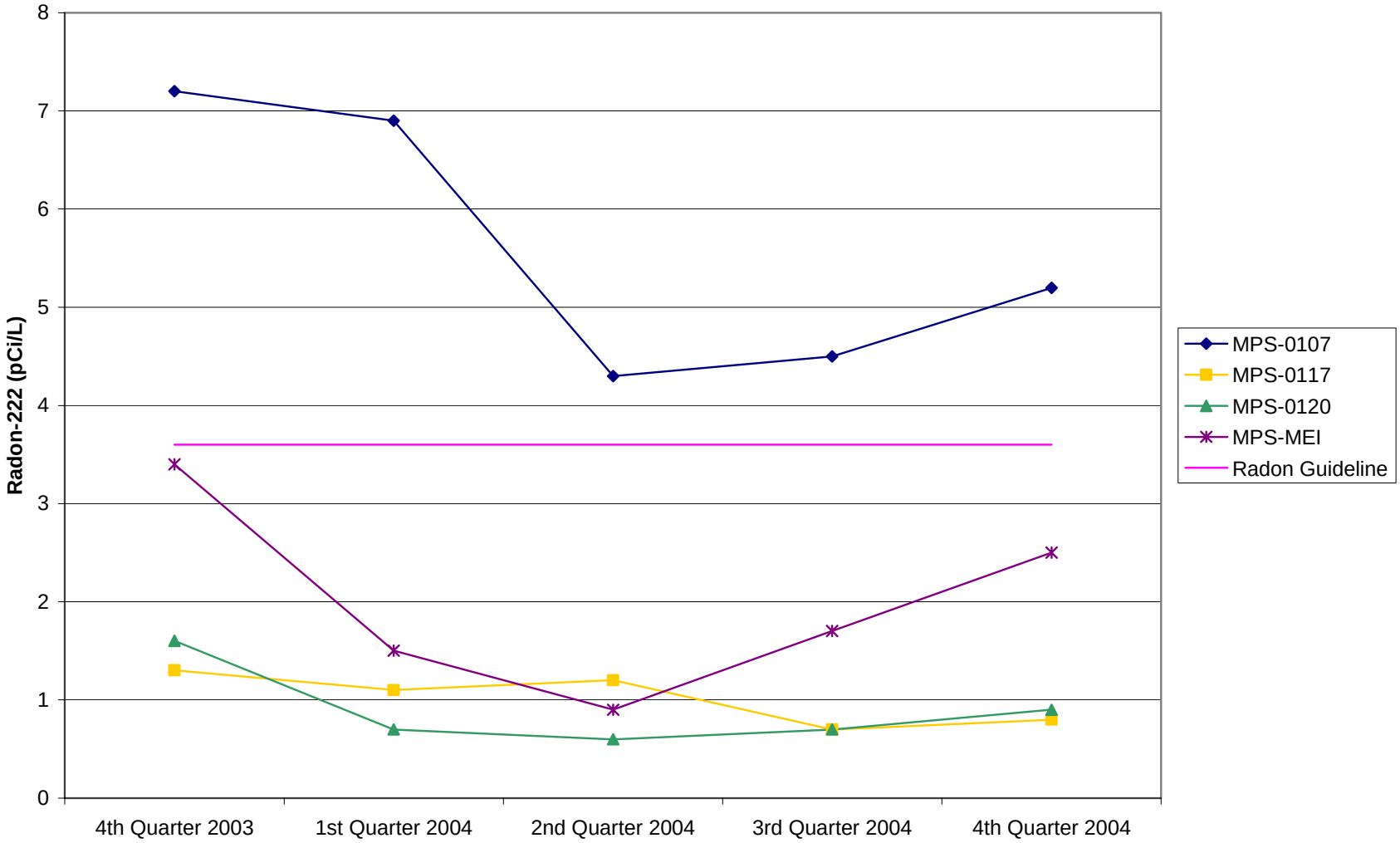


Figure 5. Moab Atmospheric Radon-222 Concentration

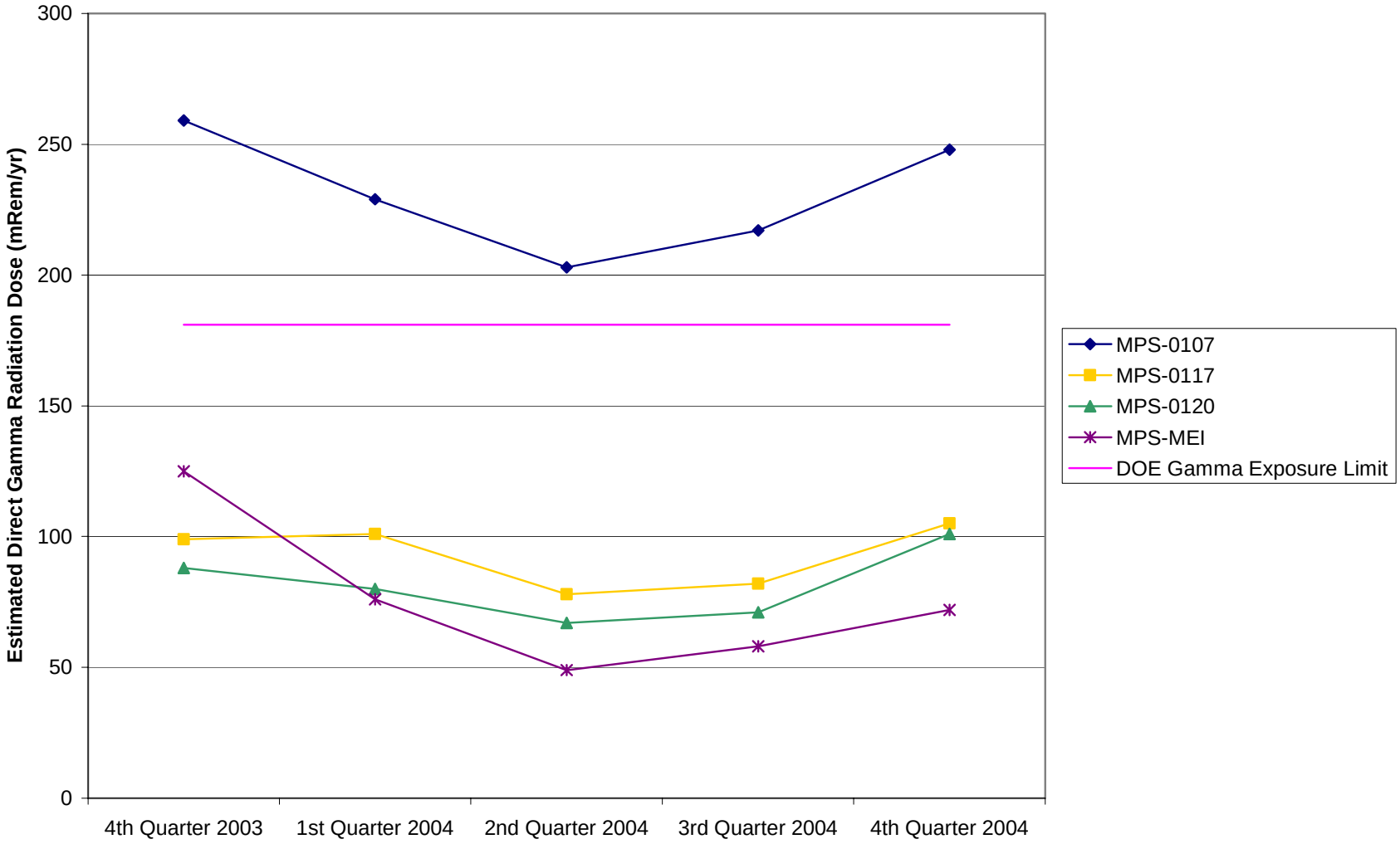


Figure 6. Moab Direct Gamma Radiation Dose

SAMPLING LOCATION MAPS

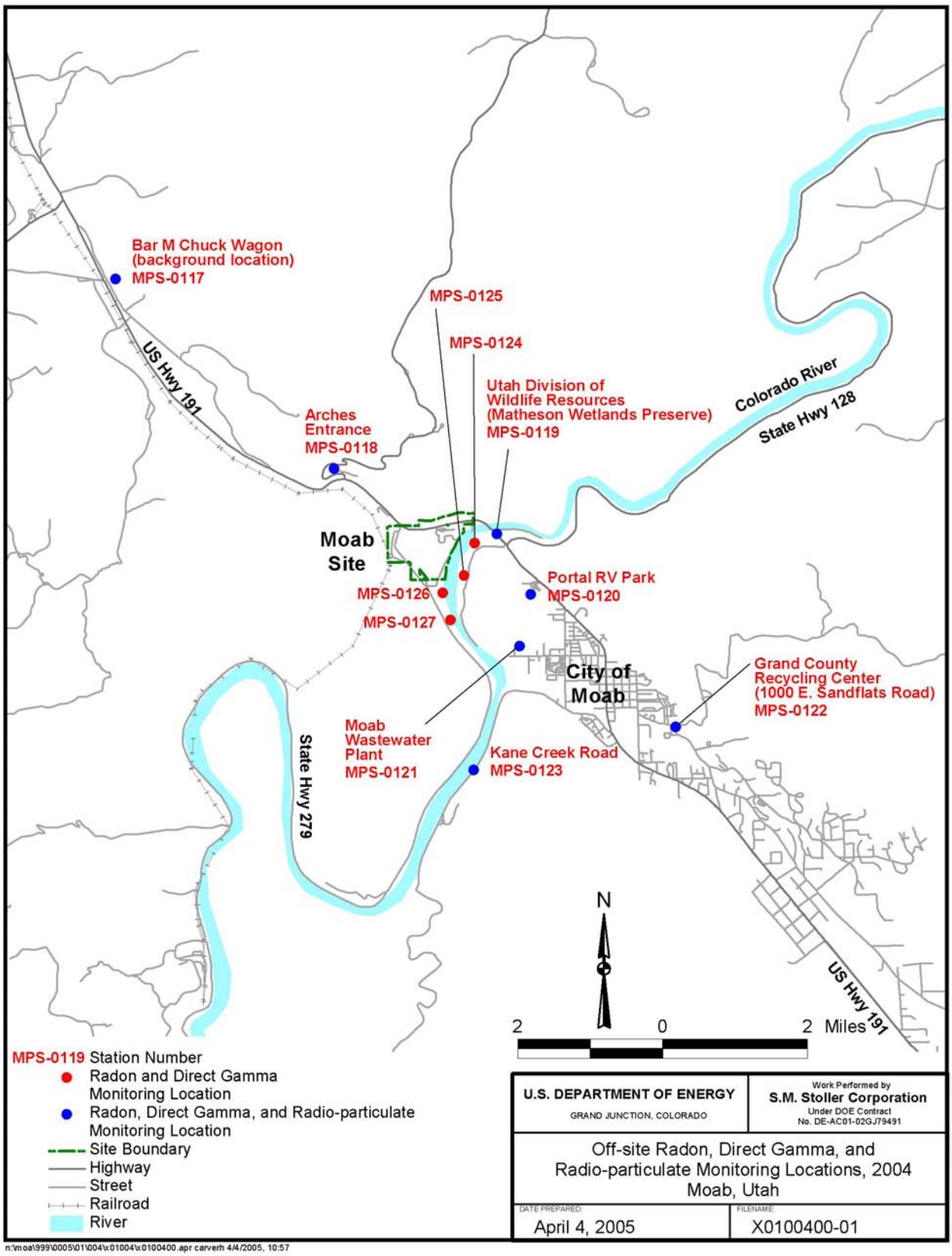


Figure 7. Off-site Radon, Direct Gamma, and Radio-particulate Monitoring Locations, 2004

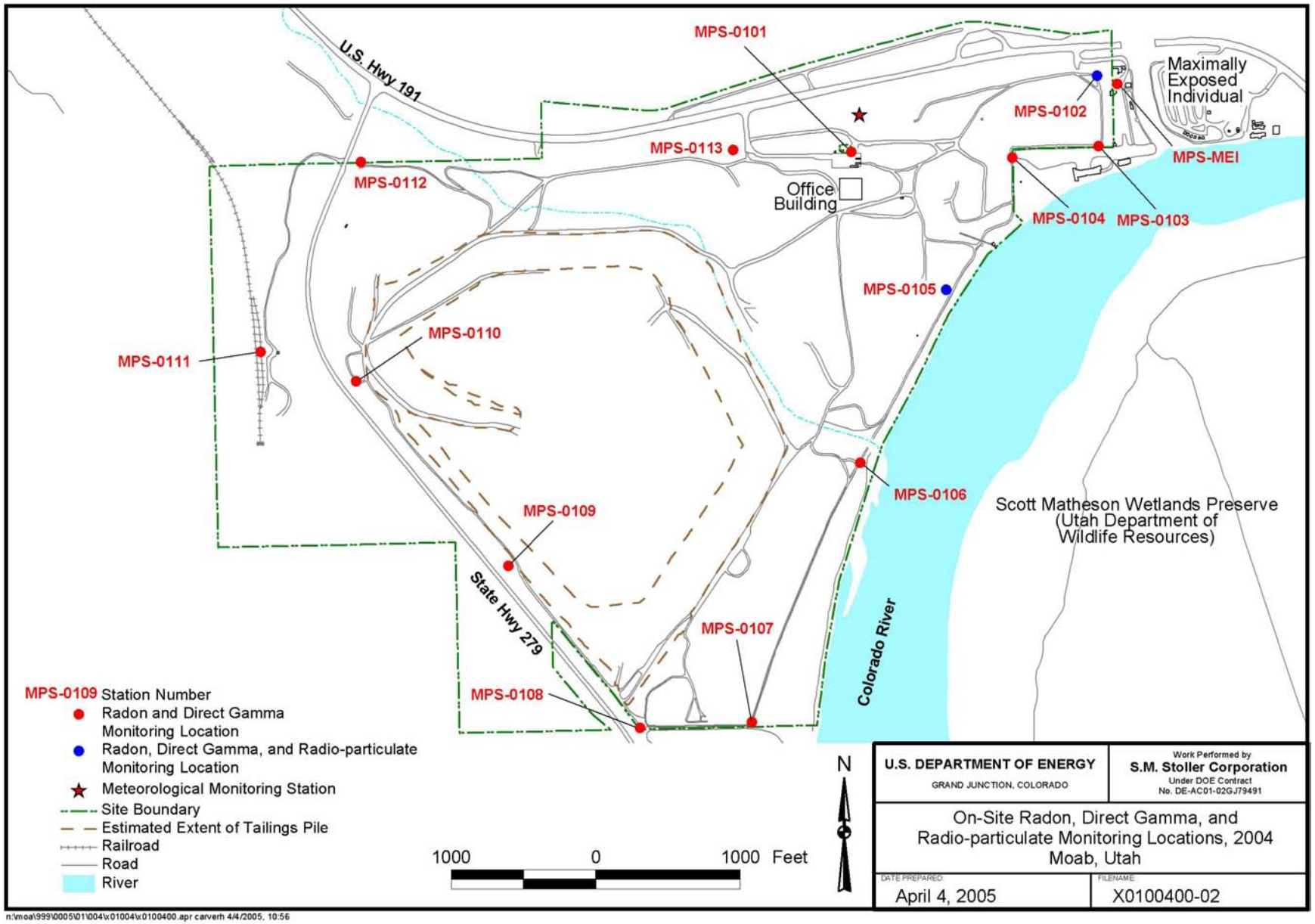


Figure 8. On--site Radon, Direct Gamma, and Radio-particulate Monitoring Locations, 2004